#32

Serial No. 09/746,933

PATENT

PB

6/4/04

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	BRUZZONE et al.	Examiner:	Ricky D. Shafer
Serial No.:	09/746,933	Group Art Unit:	2872
Filed:	December 22, 2000	Docket No.:	49837US051
Title:	REFLECTIVE LCD PROJECTION SYSTEM USING A WIDE-ANGLE POLARIZING BEAM SPLITTER		

CERTIFICATE UNDER 37 C.F.R. 1.10:
'Express Mail' mailing number:
Date of Deposit:
The undersigned hereby certifies that this Transmittal Letter and the paper or fee, as described herein, are being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

By: _____
Name

APPELLANT'S BRIEF ON APPEAL

Mail Stop Appeal Brief – Patents
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This Appeal Brief is presented in support of the Notice of Appeal submitted to the U.S. Patent and Trademark Office by facsimile on August 6, 2003, from the final rejection of claims 1, 2, 4-7 and 9-13 of the above-identified application, as set forth in the Office Action dated May 9, 2003.

A check for $320.00 to cover the required fee for filing this Brief is enclosed. An original and two copies of the Brief are enclosed herewith.

I. REAL PARTY OF INTEREST

The Real Party of Interest is 3M Innovative Properties Company, a Delaware corporation and a wholly owned subsidiary of 3M Company. 3M Innovative Properties Company is the assignee of the instant application.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences for the above-referenced patent application.

III. STATUS OF CLAIMS

Claims 1, 2, 4-7 and 9-13, as set forth in Appendix 1 attached herewith, are pending and are the subject of the present appeal.

The case was originally filed with claims 1-24. In an amendment dated November 27, 2001, claim 25 was added and minor corrections were made to claims 2, 3, 10 and 17. In a paper issued on February 27, 2002, (Appendix 2-A), Applicants were required to elect one of two species. In a response dated March 27, 2002 (Appendix 2-B), Applicants made preliminary amendments to the claims, canceling claims 20 and 21, and elected Species B, indicating that all pending claims read on the elected species. A restriction requirement and supplemental species election was issued on June 18, 2002 (Appendix 2-C). A response to the restriction requirement was submitted on July 18, 2002 (Appendix 2-D), in which Group I, claims 1-12 and 25, was elected with traverse. Also, the Appellants selected, with traverse, the following species: i) a rear projection system; ii) the first polarization direction being s-polarization and iii) the beamsplitter being a multilayer film beamsplitter. Appellants also indicated that claims 13 and 19 were generic.

An Office Action was issued on October 24, 2002 (Appendix 2-E). In the Office Action, the Examiner indicated that although claim 13 was considered to be generic, claim 19 was not considered to be generic. Claims 3, 8, 14-19 and 22-25 were withdrawn from consideration, and claims 1, 2, 4-7 and 9-13 were rejected. In a subsequent response (Appendix 2-F), mailed January 24, 2003, Appellants added new claim 26. In the Final Office Action dated May 9, 2003, (Appendix 2-G), claim 26 was

withdrawn from consideration. Consequently, claims 3, 8, 14-19 and 22-26 are currently withdrawn from consideration, and claims 1, 2, 4-7 and 9-13 are pending.

IV. STATUS OF AMENDMENTS

A response to the final Office Action dated May 9, 2003, was submitted by Appellants on July 9, 2003 (Appendix 2-H). Appellants presented arguments in this response to distinguish the claimed subject matter from the cited prior art, and requesting the Examiner to reconsider the claims.

By way of Advisory Action, mailed July 28, 2003, (Appendix 2-I), this Response was deemed not to place the application in condition for allowance, for the reasons set forth in the Final Office Action.

Since the response of May 9, 2003 included no amendments to the claims, there are no outstanding amendments. Therefore, the list of appealed claims presented in Appendix 1 lists the claims as finally rejected in the Office Action of May 9, 2003.

V. SUMMARY OF THE INVENTION

The invention is best described first with respect to claim 13. Claim 13 is directed to a projection system, for example such as is shown in FIGs. 1b and 2b below, and described generally at page 10, line 23 – page 14, line 23. The projection system includes a Cartesian polarizing beam splitter defining a first tilt axis and a color separation prism assembly that has a second tilt axis. The Cartesian polarizing beam splitter and the prism assembly are arranged such that the first and the second tilt axes are perpendicular to each other.

A definition of a Cartesian PBS is presented at page 7, lines 16-17, *viz.* a Cartesian PBS is one in which the polarization of the separate beams is referenced to invariant, generally orthogonal, principal axes of the PBS. A Cartesian PBS is further defined in the parent case (U.S. 6,485,997 B1), incorporated in the present application by reference, as having a structural orientation defining fixed polarization axes. A reflective Cartesian PBS substantially reflects those components of a beam of light

which are polarized along one such fixed axis, called the Material Axis (col. 4, lines 17-22).

Consequently, the interaction of the Cartesian PBS is characterized by how the incident light is polarized with respect to the PBS axis. For light in a polarization state that is transmitted by the PBS, a Cartesian PBS transmits substantially all the incident light, even if the incident light is not polarized parallel to the plane of incidence, so long as the light is polarized parallel to the correct axis of the polarizer. Examples of Cartesian polarizers include multiple polymer layer film polarizers and wire grid polarizers.

The tilt axis of the Cartesian PBS is shown in FIG. 2b as axis 56. The tilt axis lies in the plane of a reflecting/transmitting surface, and represents that axis about which the reflecting/transmitting surface is rotated, or tilted, so that the reflecting/transmitting surface is not normal to the incident light. Accordingly, light 60 enters the PBS 30 and is reflected by the PBS film 32 which is rotated about the tilt axis 56 so as to reflect the light at an angle of approximately 90°. The tilt axis is perpendicular to the plane of incidence, i.e. the plane formed by the directions of the incident light and the reflected light.

The light reflected from the PBS 30 is directed into the color prism assembly 36. The color prism assembly 36 has color separating surfaces that are non-normal to the incident light. The tilt axes of the color prism assembly are shown as axes 58. These tilt axes represent the axes about which the color separating surfaces would be rotated to make these surfaces normal to the incident light. In FIG. 2b, the tilt axes 58 of the prism assembly are perpendicular to the tilt axis 56 of the PBS 30. This contrasts with the system shown in FIG. 2a below, in which the tilt axes 58 of the prism assembly are parallel with the tilt axis of the PBS 30. In the invention of claim 13, the prism assembly has a tilt axis that is perpendicular to the tilt axis of the PBS, like the embodiment illustrated in FIG. 2b.

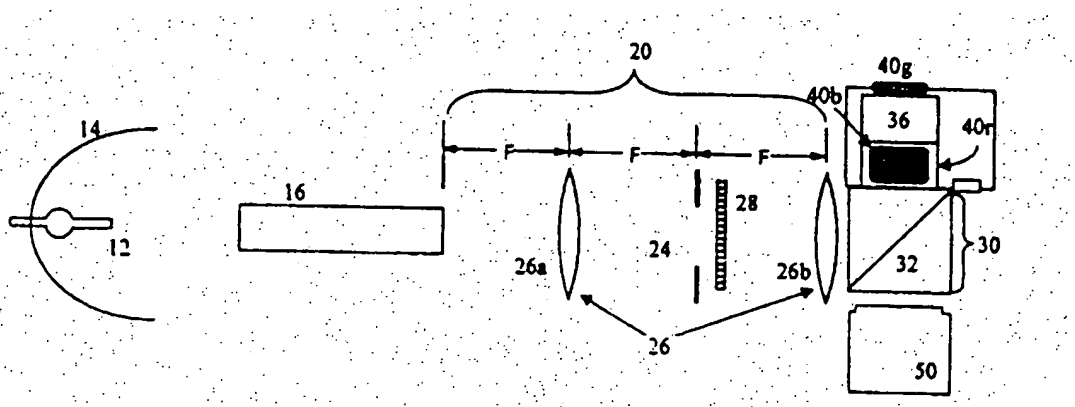

Fig. 1b

FIG. 1b from the present application

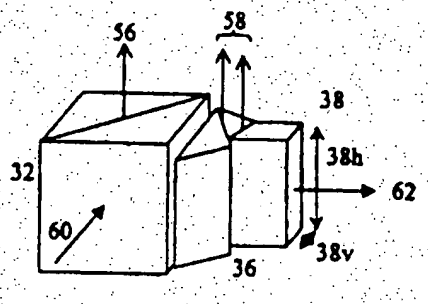

Figure 2a

FIG. 2a from the present application

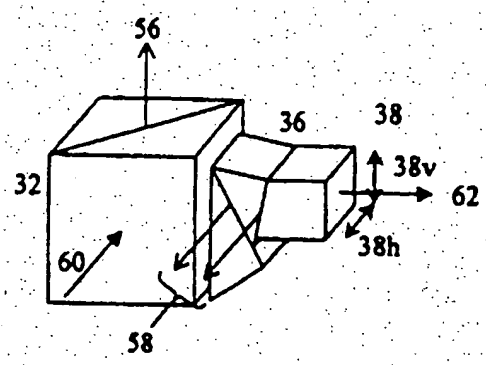

Figure 2b

FIG. 2b from the present application

Since the tilt axis for an optical element lies perpendicular to the plane of incidence, i.e. the plane formed by the incoming and reflected light, a straightforward test for determining whether the tilt axis for the PBS is perpendicular to the tilt axis of the prism assembly is to examine the reflection planes for the PBS and the prism assembly. If the reflection planes of the PBS and prism assembly are perpendicular, then the tilt axes are perpendicular. If the reflection planes are parallel, then the tilt axes are parallel.

The invention of claim 1 is also described generally at page 10, line 23 – page 14, line 23, and with respect to FIGs. 1b and 2b. Claim 1 is directed to an optical imaging system that has an illumination system providing a beam of light, the illumination system having an f/# less than or equal to 2.5. A Cartesian polarizing beam-splitter has a first tilt axis and is oriented to receive the beam of light. The Cartesian polarizing beam splitter nominally polarizes the beam of light with respect to the Cartesian beam-splitter. A first polarized beam of light having a first polarization direction is folded by the Cartesian polarizing beam splitter and a second polarized beam of light having a second polarization direction is transmitted by the Cartesian polarizing beam splitter. This is shown in FIG. 1b, in which light from the light source 12 passes to the PBS 30. The PBS folds, by reflecting, light in the first polarization state and transmits light in the second polarization state.

A color separation and recombination prism 36 is optically aligned to receive one of the polarized beams of light. The prism has a second tilt axis, a plurality of color separating surfaces, and a plurality of exit surfaces. The second tilt axis is oriented perpendicularly to the first tilt axis of the Cartesian polarizing beam-splitter so that the polarized beam is nominally polarization rotated into the opposite polarization direction with respect to the color separating surfaces and a respective beam of colored light exits through each of the exit surfaces. In other words, if the PBS directs a beam of s-polarized light to the color prism, then that light is incident on the prism as p-polarized light because the tilt axis of the color prism is perpendicular to the tilt axis of the PBS.

There is a plurality of polarization modulating imagers, for example imagers 40b, 40g and 40r. Each imager is placed at one of the exit surfaces of the color separating

and recombining prism 36. Each imager receives one of the respective beams of colored light separated by the color separation and recombination prism. Each imager can separately modulate the polarization state of the respective incident beam of colored light.

VI. ISSUES PRESENTED FOR REVIEW

A. Whether claim 13 is rejected under 35 U.S.C. § 102(b) as being anticipated by Nagashima (JP 63039394).

B. Whether claim 13 is rejected under 35 U.S.C. § 102(e) as being anticipated by Bryars (U.S. Patent No. 5,986,815) (Bryars '815).

C. Whether claim 13 is rejected under 35 U.S.C. § 102(e) as being anticipated by Bryars et al. (U.S. Patent No. 6,144,498) (Bryars '498).

D. Whether claim 13 is rejected under 35 U.S.C. § 102(e) as being anticipated by Kuijper (U.S. Patent No. 6,250,762 B1).

E. Whether claim 13 is anticipated under 35 U.S.C. § 102(e) by Knox (U.S. Patent No. 6,390,626 B2).

F. Whether claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nagashima in view of Duwaer et al. (U.S. Patent No. 5,146,248) (Duwaer).

G. Whether claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bryars '815 in view of Duwaer.

H. Whether claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bryars '498 in view of Duwaer.

I. Whether claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kuijper in view of Duwaer.

J. Whether claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Knox in view of Duwaer.

VII. GROUPING OF CLAIMS

For consideration on this appeal, Appellant has grouped the Claims according to the grounds of rejection made in the final Office Action, as shown below:

Issue A: Claim 13 only

Issue B: Claim 13 only

Issue C: Claim 13 only

Issue D: Claim 13 only

Issue E: Claim 13 only

Issue F: Group 1: 1, 2, 4-7 and 9-12

Issue G: Group 1: 1, 2, 4-7 and 9-12

Issue H: Group 1: 1, 2, 4-7 and 9-12

Issue I: Group 1: 1, 2, 4-7 and 9-12

Issue J: Group 1: 1, 2, 4-7 and 9-12

VIII. ARGUMENTS

Issue A: 102 Rejection of claim 1 based on Nagashima

Claim 13 is rejected under 35 U.S.C. §102 (b) as being anticipated by Nagashima (JP 63039394). Nagashima shows, in FIG. 1, a projection system having a polarizing beamsplitter (21) (PBS) that reflects light from a light source (23) towards a color prism assembly (11). FIG. 1 from Nagashima is shown below, along with FIG. 2b of the present application for comparison.

To anticipate a claim, the reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628,631, 2 USPQ2d 1051 1053 (Fed. Cir.) 1987). "The identical invention must be shown in as complete detail as is contained in the...claim." Richardson v. Suzuki Motor Co., 868 F. 2d1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Therefore, if a reference does not teach every element of the claim, then the reference does not anticipate the claim (MPEP § 2131).

Appellants' contend that Nagashima fails to teach all of the elements of claim 13 on at least two grounds, *viz.* i) the orientation of the tilt axes and ii) the lack of teaching a Cartesian polarizing beamsplitter. These are addressed in turn.

i) Orientation of the Tilt Axes

It is important to determine the direction of the tilt axes of the PBS and the color prism assembly in Nagashima's system. In order to illustrate the argument, FIG. 1 from Nagashims is shown below, along with FIG. 2b of the present application for comparison. As is stated above in the description of the invention provided above, the tilt axis lies in the plane of a reflecting/transmitting surface, and represents that axis about which the reflecting/transmitting surface is rotated, or tilted, so that the reflecting/transmitting surface is not normal to the incident light. For the PBS, the tilt axis lies in the plane of the polarized reflector and points out of the plane of the figure. As a result, the light is reflected in a plane parallel to the plane of the figure. Likewise, for the color prism assembly, the tilt axes lie out of the plane of the figure, with the result

that the color prism assembly reflects the light in a plane parallel to the plane of the figure. Consequently, the tilt axis of the Nagashima's PBS is parallel to the tilt axes of the color prism.

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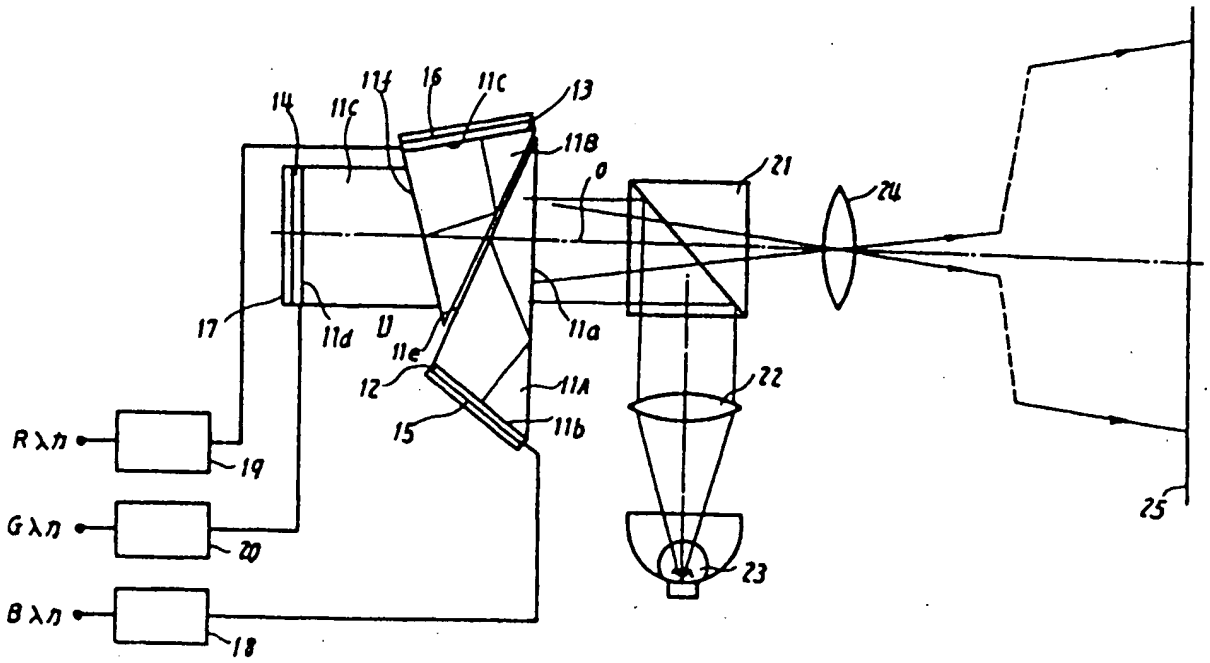


FIG. 1 of Nagashima

Figure 2b

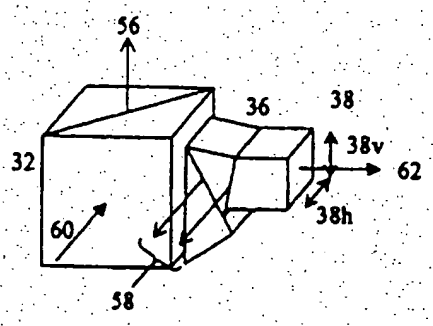


FIG. 2b of present Application.

Nagashima's system is different from the invention of claim 13, in which the tilt axes of the color prism and the PBS are perpendicular to one another.

Another way of viewing this is to determine where the planes of incidence lie for the PBS and for the color prism assembly. As is stated in the description of the invention provided above, where the plane of incidence for the prism assembly is perpendicular to that for the PBS, then the tilt axes are perpendicular. On the other hand, where the planes of incidence are parallel, then the tilt axes are parallel. Light reflected by Nagashima's PBS remains in the plane of the figure, and so the plane of incidence for Nagashima's PBS lies parallel to the plane of the figure. Likewise, the light reflected by Nagashima's color prism assembly remains in the plane of the figure, and so the plane of incidence for Nagashima's color prism assembly lies parallel to the plane of the figure. Accordingly, the tilt axes of the Nagashima's PBS and color prism assembly are parallel and are not perpendicular.

Thus, Nagashima fails to teach that the tilt axes of the PBS and color prism are perpendicular.

ii) Lack of Teaching of a Cartesian Polarizing Beamsplitter

Appellants also contend that Nagashima fails to teach the use of a Cartesian polarizing beamsplitter. As is stated above, a Cartesian polarizing beamsplitter is one in which the polarization of the separate beams is referenced to invariant, generally orthogonal, principal axes of the PBS, these axes being set by material properties of the PBS itself. For example, the principal axes of the PBS may be determined by the direction of wires in a wire grid polarizer or by the fast and slow axes of the birefringent layers in a multiplayer optical film polarizer. These principal axes arise due to the structure of the PBS, and are not defined simply by the function of the device.

Applicants respectfully contend that the Examiner is obliged to use the definition for the term "Cartesian polarizing beamsplitter" (Cartesian PBS) provided in the Specification: it is well known that the Applicant may be his own lexicographer so long as the meaning assigned to the term is not repugnant to the term's well known usage, *In re Hill* 161 F.2d 367, 73 USPQ 482 (CCPA 1947) (cited in MPEP § 2111.02).

Appellants contend that the phrase "Cartesian PBS" is not repugnant to its well known usage, if there is, in fact, well known usage of the term.

Accordingly, the term "Cartesian PBS" should be ascribed its meaning as presented in the Specification, i.e. it is a PBS in which the polarization of the beams is referenced to invariant principal axes of the PBS itself. Thus X-polarized light incident on the PBS is reflected as X-polarized light, irrespective of whether or not the polarization of the X-polarized light is perpendicular to the plane of incidence or not.

This contrasts with the performance of a conventional PBS, commonly referred to as a MacNeille PBS. In the MacNeille PBS, the light is separated into different polarization states primarily based on the effect that the reflection for p-polarization is zero when incident at Brewster's angle. Therefore, in a MacNeille polarizer, the polarization state of the incident light is characterized in terms of how the incident light is polarized with respect to the plane of incidence. As an example, incidence at Brewster's angle on a conventional polarizer surface results in light being totally transmitted, without reflection, only if the polarization of the light is parallel to the plane of incidence (p-polarized). If the light is incident on the surface in a direction not completely parallel to the plane of incidence, then there exists a reflected component. A MacNeille PBS works by presenting many surfaces for reflection: the overall effect of the many surfaces is that the reflectivity is low for p-polarized light and high for s-polarized light.

Thus, there is a significant difference between a Cartesian PBS and a MacNeille PBS. Nagashima fails to teach a Cartesian PBS.

In the Final Office Action, it is stated that the Examiner disagrees [with the contention that Nagashima fails to teach a Cartesian PBS] and is of the opinion that the PBS taught by Nagashima ...is inherently a Cartesian PBS due to the fact that the PBS splits incident light into first and second substantially polarized beams, wherein the polarization states thereof are inherently referenced to some co-ordinate system. Appellants respectfully contend that this description of a Cartesian PBS is in error. A Cartesian PBS does not simply produce first and second light beams whose polarization states are inherently referenced to some co-ordinate system. When a Cartesian PBS is used, the polarization states of the first and second beams are referenced to the

principal material axes of the PBS itself, and not to some arbitrary co-ordinate system. Nagashima simply fails to teach that the polarization states of the first and second beams are referenced to the principal material axes of the PBS itself. Instead, Nagashima refers to s-polarization and p-polarization, where the polarization states are referred to the plane of incidence and not to the principal material axes of the PBS itself.

Accordingly, Nagashima fails to disclose a Cartesian PBS.

Therefore, since Nagashima fails to teach all the elements of the claim, claim 13 is not anticipated by Nagashima.

Issue B: 102 Rejection of claim 13 based on Bryars '815

Claim 13 is rejected under 35 U.S.C. § 102(e) as being anticipated by Bryars (U.S. Patent No. 5,986,815) (Bryars '815).

Bryars '815 teaches a projection system having a light source (10) that illuminates a PBS (20). The light reflected from the PBS is directed to a Philips type of prism assembly (30), formed by three prisms R, G, and B. Prism R has a reflecting surface (41b) and prism G has a reflecting surface (51b). The light red light entering the prism assembly from the PBS is reflected at surface (41b) and directed to the liquid crystal light valve (90). The remainder of the light, the green and blue portions, passes through surface (41b) to surface (51b), where the green light is reflected to the liquid crystal light valve (110) and the blue light is transmitted to the liquid crystal light valve (130).

Appellants contend that Bryars '815 also fails to teach that the tilt axes of the PBS and the color prism assembly are perpendicular, and the use of a Cartesian PBS.

i) Tilt Axes

Examination of the projection system taught by Bryars '815 (particularly FIG. 1, shown below along with FIG. 2b of the present application for comparison, and the description thereof at col. 10 line 1 - col. 12, line 41) shows that the tilt axes of the Bryars '815 system are parallel. Light is reflected from the light source in the plane of the figure, and so the tilt axis of the PBS lies perpendicularly out of the plane of the figure. Light is reflected within the prism assembly, at surfaces 41b and 51b, also within

the plane of the figure. Therefore, the tilt axes of the prism assembly also lie perpendicularly out of the plane of the figure. Accordingly, the tilt axes of the PBS and the color prism assembly are parallel, and so Bryars '815 fails to disclose that the tilt axes of the color prism assembly and the PBS are perpendicular.

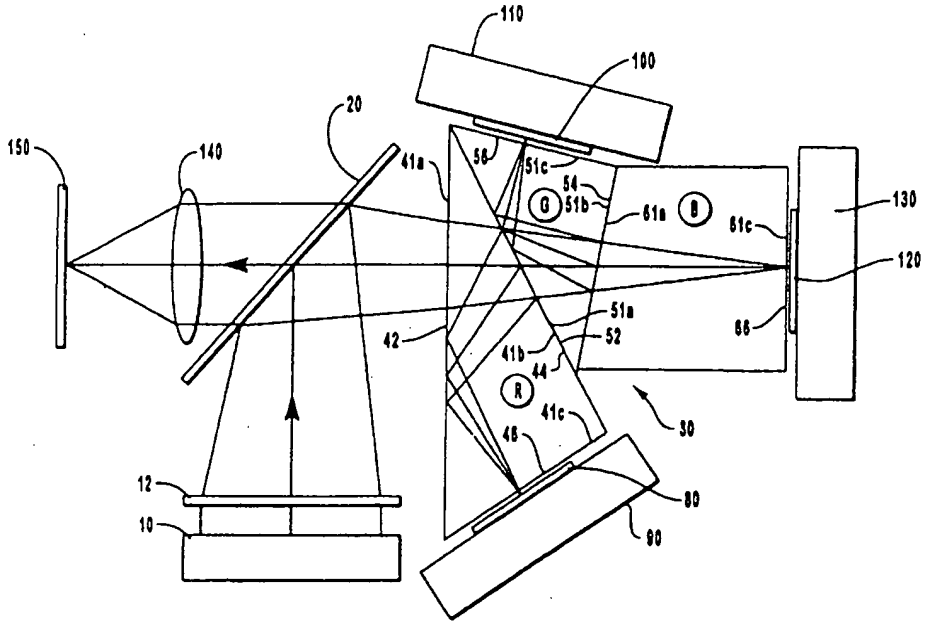


FIG. 1

FIG. 1 from Bryars '815

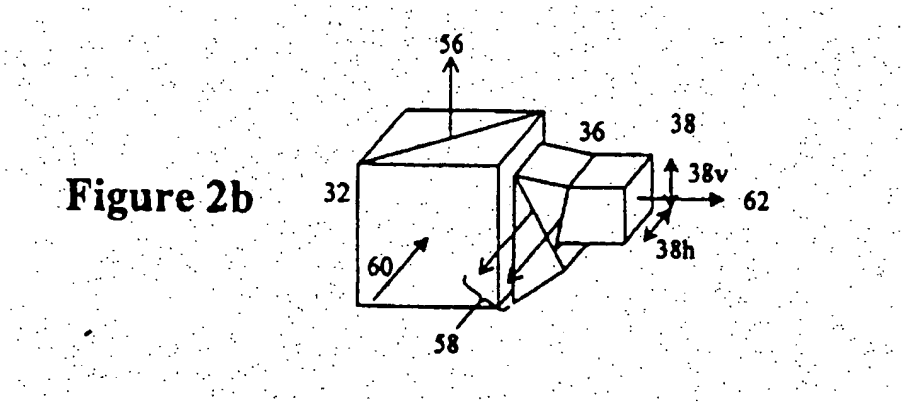


FIG. 2b from the present application

ii) Cartesian PBS

Like Nagashima, Bryars '815 fails to teach a PBS in which the polarization states of the first and second beams are referenced to principal material axes of the PBS itself. The Cartesian PBS has been described above with respect to the description fo the invention and Nagashima.

Instead, Bryars teaches (col. 10, lines 35-43) that the PBS transmits one type of polarization (either s- or p-polarized light, for the purpose of the example the transmitted light is p-polarized light) while reflecting light of the other type of polarization. S-polarized light refers to light which has its polarization vector perpendicular to the plane of incidence; whereas p-polarized light refers to light which has its polarization vector lying in the plane of incidence. Thus, Bryars '815 teaches the use of a conventional, MacNeille PBS, and not a Cartesian PBS.

Accordingly, Bryars '815 fails to teach all the elements of claim 13, and so claim 13 is not anticipated by Bryars '815.

Issue C: 102 Rejection of claim 13 based on Bryars '498

Claim 13 is rejected under 35 U.S.C. § 102(e) as being anticipated by Bryars et al. (U.S. Patent No. 6,144,498) (Bryars '498). Bryars '498 teaches a projection system (100) having a light source (102) that illuminates a PBS (106). The light reflected from the PBS is directed to a Philips type of prism assembly (10), formed by three prisms R, G, and B. Prism R has a dichroic reflective coating on exit surface 22b and prism B has a dichroic reflective coating on exit surface 24b. The red light entering the prism assembly from the PBS is reflected at surface (22b) and directed to the red liquid crystal light valve (110). The remainder of the light, the green and blue portions, passes through surface (22b) to surface (24b), where the blue light is reflected to the blue liquid crystal light valve (111) and the green light is transmitted to the green liquid crystal light valve (114).

Appellants contend that Bryars '498 also fails to teach that the tilt axes of the PBS and the color prism assembly are perpendicular, and fails to teach the use of a Cartesian PBS.

i) Tilt Axes

Examination of the projection system taught by Bryars '498 (particularly FIG. 2, shown below along with FIG. 2b of the present application for comparison, and the description thereof at col. 4 line 59 - col. 6, line 8) shows that the tilt axes of the Bryars '498 system are parallel. Light is reflected from the light source in the plane of the figure, and so the tilt axis of the PBS lies perpendicularly out of the plane of the figure. Light is reflected within the prism assembly, at both surfaces 22b and 24b, also within the plane of the figure. Therefore, the tilt axes of the prism assembly also lie perpendicularly out of the plane of the figure. Since the tilt axes of the PBS and the color prism assembly lie out of the plane of the figure, the tilt axes are parallel and so Bryars '498 fails to disclose that the tilt axes of the color prism assembly and the PBS are perpendicular.

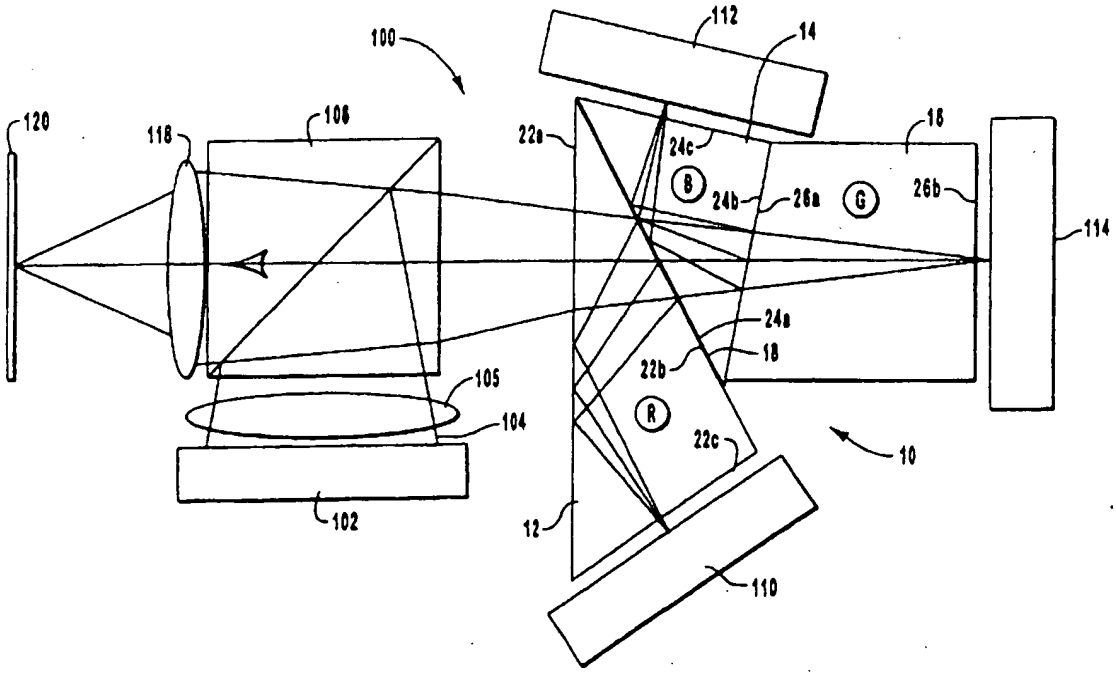


FIG. 2
(PRIOR ART)

FIG. 2 from Bryars '498

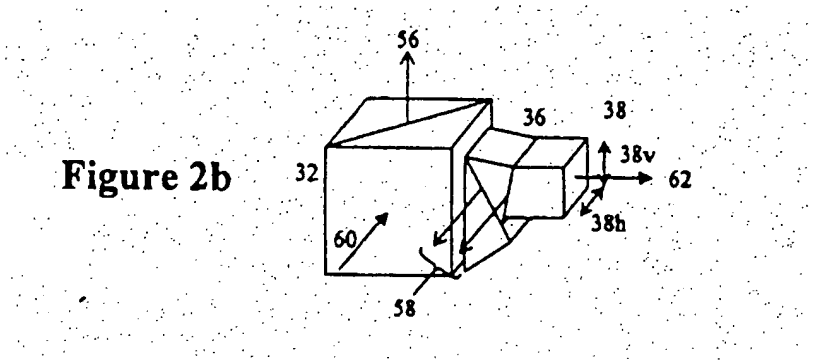


FIG. 2b from the present application

ii) Cartesian PBS

Like Nagashima, Bryars '498 fails to teach a PBS in which the polarization states of the first and second beams are referenced to principal material axes of the PBS itself. The Cartesian PBS has been described above with respect to the description of the invention and Nagashima.

Instead, Bryars '498 is silent as to the workings of the PBS. However, Bryars '498 does not teach that the PBS is of a type known to be a Cartesian PBS, nor that the PBS has principal material axes that define the polarization states of the reflected and transmitted light.

Accordingly, Bryars '498 fails to teach all the elements of claim 13, and so claim 13 is not anticipated by Bryars '498.

Issue D: 102 Rejection of claim 13 based on Kuijper

Claim 13 is rejected under 35 U.S.C. § 102(e) as being anticipated by Kuijper (U.S. Patent No. 6,250,762 B1). Kuijper teaches (FIGs. 1 and 3, and col. 2, line 62 – col. 3, line 36) a projection system having a light source (5) that illuminates a PBS (9). Light reflected by the PBS is directed to a color-separating element (17), comprised of three prisms 19, 21, and 23. Blue light is reflected at the first interface (25) between two of the prisms (19 and 23), and propagates to the light valve (15) for blue light. Red light is reflected at the second interface (27) between prisms (19 and 21) and propagates to the light valve (11) for red light. Green light passes through both

interfaces to the light valve (13) for green light. This arrangement of prisms is often referred to as a Philips prism.

Appellants contend that Kuijper also fails to teach that the tilt axes of the PBS and the color prism assembly are perpendicular, and fails to teach the use of a Cartesian PBS.

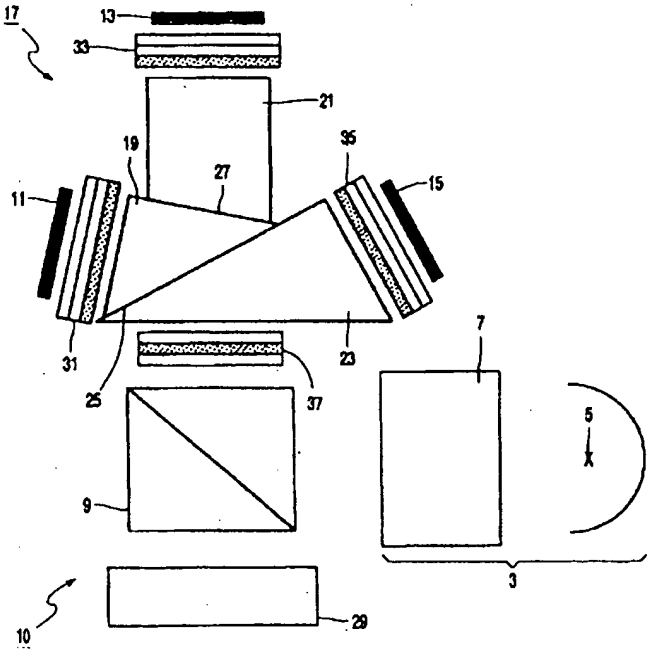


FIG. 1 from Kuijpers

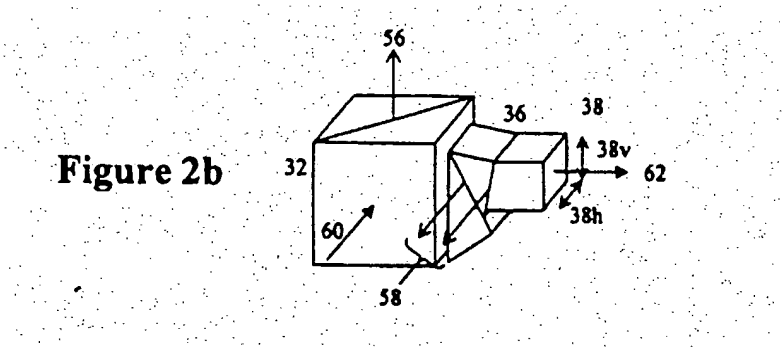


FIG. 2b from present application

i) Tilt Axes

Examination of the projection system taught by Kuijper (particularly FIG. 1, shown above along with FIG. 2b of the present application for comparison) shows that the tilt axes of Kuijper's system are parallel. Light is reflected from the light source in the plane of the figure and the tilt axis of the PBS lies perpendicularly out of the plane of the figure. Also, light is reflected within the prism assembly, at both interfaces (25 and 27), within the plane of the figure. The tilt axes of the prism assembly, therefore, also lie perpendicularly out of the plane of the figure. Accordingly, since the tilt axes of the PBS and the color prism assembly both lie out of the plane of the figure, the tilt axes of the PBS and the color prism assembly are parallel. Consequently, Kuijper fails to disclose that the tilt axes of the color prism assembly and the PBS are perpendicular.

ii) Cartesian PBS

Like Nagashima, Kuijper fails to teach a PBS in which the polarization states of the first and second beams are referenced to principal material axes of the PBS itself. The Cartesian PBS has been described above with respect to the description of the invention and Nagashima.

Instead, Kuijper is silent as to the workings of the PBS. However, Kuijper does not teach that the PBS is of a type known to be a Cartesian PBS, nor that the PBS has principal material axes that define the polarization states of the reflected and transmitted light.

Accordingly, Kuijper fails to teach all the elements of claim 13, and so claim 13 is not anticipated by Kuijper.

Issue E: 102 Rejection of claim 13 based on Knox

Claim 13 is anticipated under 35 U.S.C. § 102(e) by Knox (U.S. Patent No. 6,390,626 B2). Knox teaches a projection system having a light source (210) that illuminates a PBS (220). Light reflected by the PBS is directed to various embodiments of color separating prism assemblies, including an x-cube beamsplitter/combiner (230) in FIGs. 11, 12 and 12A, a Philips color prism (330), in FIGs. 13 and 17, a prism assembly (430) in FIG. 14, a prism (530) in FIG. 15, and a prism (630) in FIG. 16. FIGs.

13 and 14 are provided below, along with FIG. 2b from the present application for comparison. Each of the prism assemblies taught by Knox includes reflecting surfaces for separating and combining light of different colors. The light is directed from the prism assembly to two or three imagers, and is reflected to the prism assemblies where the light of different color is recombined. The recombined light then passes to the PBS and the image light that has been polarization rotated is passed to the projection lens (260).

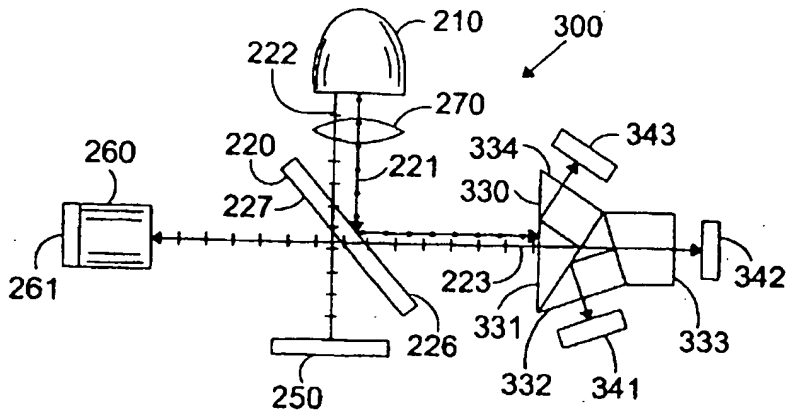


FIG. 13

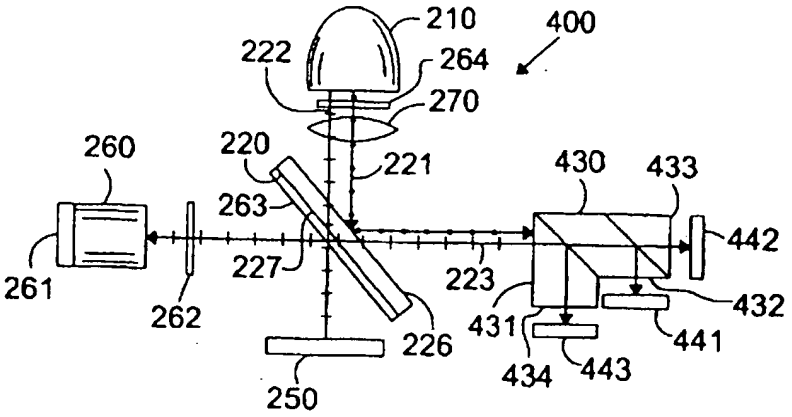


FIG. 14

FIGs. 13 and 14 from Knox

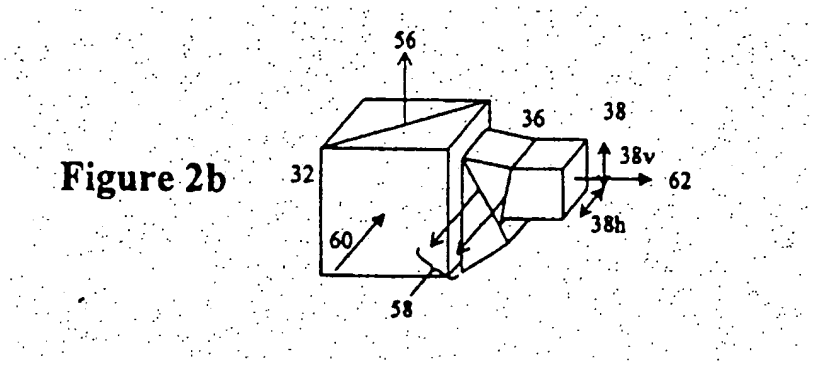


FIG. 2b from the present application.

The tilt axes of the PBS, however, and the reflecting surfaces in each prism assembly are all parallel. In each case, the plane of reflection for the PBS lies in the plane of the figure: therefore the tilt axis of the PBS in each case lies out of the plane of the figure. Also, the plane of reflection for each of the prism assemblies lies in the plane of the figure, and so the tilt axes of the prism assemblies lie out of the plane of the figure. Since the tilt axes of the PBS and the prism assemblies all lie out of the plane of the figure, the tilt axes are parallel. Moreover, there is no teaching in Knox that the prism assemblies could be rotated from the orientations shown in the figures to positions in which the tilt axes of the PBS and prism assemblies are perpendicular.

Therefore, Knox fails to teach that the tilt axes are perpendicular, and fails to teach all the elements of claim 13. Accordingly, claim 13 is not anticipated by Knox.

Issue F: 103 Rejection of claims 1, 2, 4-7 and 9-12 based on Nagashima and Duwaer

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nagashima in view of Duwaer et al. (U.S. Patent No. 5,146,248) (Duwaer).

It is stated in the Final Office Action that Nagashima discloses all of the subject matter claimed, as described in the discussion of the rejection of claim 13, with the exception for explicitly stating that the illumination system has an f/# less than or equal to 2.5. It is further stated in the Office action that Duwaer teaches that it is well known to use an illumination system having an f/# less than or equal to 2.5 in the same field of

endeavor for the purpose of producing a large cone of light, and that it would have been obvious at the time the invention was made to modify the illumination system of Nagashima to include an illumination system having a f/# less than or equal to 2.5 as taught by Duwaer, in order to increase the brightness efficiency without sacrificing contrast or desirable brightness versus contrast ratio.

Duwaer discusses a light valve projection system based on the use of three separate light sources (30, 40 and 50) emitting light at different wavelengths (col. 6, line 59 – col. 7, line 2). Respective reflectors (34, 44, and 54) collect the light emitted by the light sources and direct the light through respective transmissive light valves (36, 46 and 56). The image light transmitted through the light valves is combined in a Philips color prism formed from three prisms (38, 48, 58), and is then projected using a projection lens (60). Duwaer indicates that the illumination system for this transmission-type imaging system may be as low as f/2.0 (col. 5, line 58 – col. 6, line 14) .

Three criteria must be met to establish a *prima facie* case of obviousness. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. Finally, the prior art reference, or combination of references, must teach or suggest all the claim limitations. MPEP § 2142. Appellants respectfully contend that the prior art fails to disclose all the claim limitations and there would be no motivation to combine the references as proposed by the Examiner.

In claim 1, like claim 13, the tilt axes of the PBS and color prism assembly are perpendicular. It was shown above that Nagashima fails to teach that the tilt axes of the PBS and the color prism assembly are perpendicular. Duwaer fails to correct this deficiency. In fact, Duwaer's system does not even include a PBS. Therefore, neither of the proposed references teach or suggest that the tilt axes of the PBS and the color prism assembly are perpendicular.

The optical imaging system of claim 1, like claim 13, includes a Cartesian PBS. It was shown above that Nagashima fails to teach or suggest the use of a Cartesian PBS. Duwaer also fails to rectify this deficiency, since Duwaer's projection system

does not use a PBS. Therefore, neither of the proposed references teach or suggest a Cartesian PBS.

Accordingly, the proposed combination of Nagashima and Duwaer fails to teach or suggest all the elements of claim 13.

Furthermore, Appellants respectfully suggest that there would be no reasonable expectation of success to combine the references in the manner suggested in the Office Action. First, it is important to note that Duwaer teaches only the use of f/2.0 illumination for a system that is based on transmissive imagers. Duwaer does not teach or suggest that illumination units with such a low f/# are suitable for use with reflective imagers: projection systems that use transmissive imagers typically do not use a PBS. Therefore, for one of ordinary skill in the art to have any reasonable expectation of success in combining Duwaer's light source with Nagashima's system, the one of ordinary skill would be required to know that a PBS capable of maintaining an acceptable level of contrast with such a low f/# was available. There is no teaching in Nagashima, however, that would lead of ordinary skill in the art to believe that image contrast would be maintained when using a light source with such a wide angle of illumination.

The problems associated with using a conventional polarizer in a projection system having an f/# of 2.5 or less were known and are discussed at length in the parent application (U.S. 09/312,917), which is incorporated by reference in the present application. Appellants respectfully suggest that, since the solution to achieving a truly a wide angle polarizer was not known to one of ordinary skill, it would not be reasonable for one of ordinary skill to combine an illumination system, as taught by Duwaer, into Nagashima's system.

Accordingly, two of the three criteria for a *prima facie* case for obviousness have not been met, *viz.* that all the claim elements be taught in the proposed combination of references and that one of ordinary skill would have a reasonable expectation of success in making the combination. Consequently, claim 1 is not unpatentable over the proposed combination of references, and so claim 1 is allowable.

While Appellants have selected claim 1 to represent Group 1 in this Issue, Appellants do not admit that claims 2, 4-7 and 9-12 are not separately patentable over the proposed combination of Nagashima and Duwaer.

Issue G: 103 Rejection of claims 1, 2, 4-7 and 9-12 based on Bryars '815 and Duwaer

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bryars '815 in view of Duwaer, both of which have been described above. It was shown above that Bryars '815 fails to teach that the tilt axes of the PBS and the color prism assembly are perpendicular. Duwaer fails to correct this deficiency: Duwaer's system does not include a PBS and Duwaer does not refer to the use of a PBS. Therefore, neither of the proposed references teach or suggest, either individually or in combination, that the tilt axes of the PBS and the color prism assembly are perpendicular.

The optical imaging system of claim 1, like claim 13, includes a Cartesian PBS. It was shown above that Bryars '815 fails to teach or suggest the use of a Cartesian PBS. Duwaer also fails to rectify this deficiency, since Duwaer does not refer to a PBS. Therefore, neither of the proposed references, individually or in combination, teach or suggest a Cartesian PBS. Accordingly, the proposed combination of Bryars '815 and Duwaer fails to teach or suggest all the elements of claim 1.

Furthermore, Appellants respectfully suggest that there would be no reasonable expectation of success to combine the references in the manner suggested in the Office Action, for reasons similar to those described above with respect to the proposed combination of Nagashima and Duwaer.

Two of the three requirements for a *prima facie* case of obviousness have not been met, *viz.* that all the claim elements be taught in the proposed combination of Bryars '815 and Duwaer, and that one of ordinary skill would have a reasonable expectation of success in making the combination. Consequently, claim 1 is not unpatentable over the proposed combination of Bryars '815 and Duwaer, and so claim 1 is allowable.

While Appellants have selected claim 1 to represent Group 1 in this Issue, Appellants do not admit that claims 2, 4-7 and 9-12 are not separately patentable over the proposed combination of Bryars '815 and Duwaer.

Issue H: 103 Rejection of claims 1, 2, 4-7 and 9-12 based on Bryars '498 and Duwaer

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bryars '498 in view of Duwaer, both of which have been described above. It was shown above that Bryars '498 fails to teach that the tilt axes of the PBS and the color prism assembly are perpendicular. Duwaer fails to correct this deficiency: Duwaer's system does not include a PBS. Therefore, neither Bryars '498 nor Duwaer teach or suggest, either individually or in combination, that the tilt axes of the PBS and the color prism assembly are perpendicular.

The optical imaging system of claim 1, like claim 13, includes a Cartesian PBS. It was shown above that Bryars '498 fails to teach or suggest the use of a Cartesian PBS. Duwaer also fails to rectify this deficiency, since Duwaer does not refer to a PBS. Therefore, neither of the proposed references, individually or in combination, teach or suggest a Cartesian PBS. Accordingly, the proposed combination of Bryars '498 and Duwaer fails to teach or suggest all the elements of claim 1.

Furthermore, Appellants respectfully suggest that there would be no reasonable expectation of success to combine the references in the manner suggested in the Office Action, for reasons similar to those described above with respect to the proposed combination of Nagashima and Duwaer.

The *prima facie* case of obviousness has failed because the proposed combination of Bryars '498 and Duwaer fails to teach or suggest all the elements and because one of ordinary skill would have no reasonable expectation of success in making the combination. Consequently, claim 1 is not unpatentable over the proposed combination of Bryars '498 and Duwaer, and so claim 1 is allowable.

While Appellants have selected claim 1 to represent Group 1 in this Issue, Appellants do not admit that claims 2, 4-7 and 9-12 are not separately patentable over the proposed combination of Bryars '498 and Duwaer.

Issue I: 103 Rejection of claims 1, 2, 4-7 and 9-12 based on Kuijper and Duwaer

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kuijper in view of Duwaer, both of which have been described above. It was shown above that Kuijper fails to teach that the tilt axes of the PBS and the color prism assembly are perpendicular. Duwaer fails to correct this deficiency: Duwaer's system does not even include a PBS. Therefore, neither Kuijper nor Duwaer teach or suggest, either individually or in combination, that the tilt axes of the PBS and the color prism assembly are perpendicular.

The optical imaging system of claim 1, like claim 13, includes a Cartesian PBS. It was shown above that Kuijper fails to teach or suggest the use of a Cartesian PBS. Duwaer also fails to rectify this deficiency, since Duwaer does not refer to a PBS. Therefore, neither of the proposed references, individually or in combination, teach or suggest a Cartesian PBS. Accordingly, the proposed combination of Kuijper and Duwaer fails to teach or suggest all the elements of claim 13.

Furthermore, Appellants respectfully suggest that there would be no reasonable expectation of success to combine the references in the manner suggested in the Office Action, for reasons similar to those described above with respect to the proposed combination of Nagashima and Duwaer.

The criteria for the *prima facie* case of obviousness have not been met. In particular, the proposed combination of refernefces fails to teach or suggest all the elements of claim 1 and one of ordinary skill would have no reasonable expectation of success in making the combination. Consequently, claim 1 is not unpatentable over the proposed combination of Kuijper and Duwaer, and so claim 1 is allowable.

While Appellants have selected claim 1 to represent Group 1 in this Issue, Appellants do not admit that claims 2, 4-7 and 9-12 are not separately patentable over the proposed combination of Kuijper and Duwaer.

Issue J: 103 Rejection of claims 1, 2, 4-7 and 9-12 based on Knox and Duwaer

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Knox in view of Duwaer, both of which have been described above.

It was shown above that Knox fails to teach that the tilt axes of the PBS and the color prism assembly are perpendicular. Duwaer fails to correct this deficiency: Duwaer's system does not include a PBS. Therefore, neither Knox nor Duwaer teach or suggest, either individually or in combination, that the tilt axes of the PBS and the color prism assembly are perpendicular.

Furthermore, Appellants respectfully suggest that there would be no reasonable expectation of success to combine the references in the manner suggested in the Office Action, for reasons similar to those described above with respect to the proposed combination of Nagashima and Duwaer.

The criteria for the *prima facie* case of obviousness have not been met. In particular, the proposed combination of references fails to teach or suggest all the elements of claim 1 and one of ordinary skill would have no reasonable expectation of success in making the combination. Consequently, claim 1 is not unpatentable over the proposed combination of Knox and Duwaer, and so claim 1 is allowable.

CONCLUSION

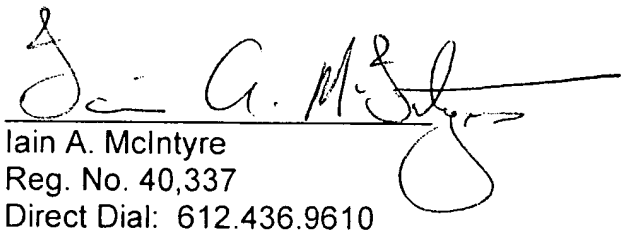
Appellants respectfully submit that claim 13 is not anticipated by the cited art and that no *prima facie* showing of obviousness has been established with respect to claims 1, 2, 4-7 and 9-12, the rejections of which are contested by Appellants. It is earnestly requested that the rejections be reversed, and that all of the pending claims 1, 2, 4-7 and 9-13 be allowed.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Iain A. McIntyre at 612-436 9610.

Respectfully submitted,

Customer No. 32692

Date: October 6, 2003

By: 

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APPENDIX 1
THE CLAIMS ON APPEAL

1. An optical imaging system comprising:
   a) an illumination system providing a beam of light, the illumination system having an f/# less than or equal to 2.5;
   b) a Cartesian polarizing beam-splitter having a first tilt axis, oriented to receive the beam of light, wherein the Cartesian polarizing beam splitter nominally polarizes the beam of light with respect to the Cartesian beam-splitter, wherein a first polarized beam of light having a first polarization direction is folded by the Cartesian polarizing beam splitter and a second polarized beam of light having a second polarization direction is transmitted by the Cartesian polarizing beam splitter;
   c) a color separation and recombination prism optically aligned to receive one of the polarized beams of light, said prism having a second tilt axis, a plurality of color separating surfaces, and a plurality of exit surfaces, wherein the second tilt axis is oriented perpendicularly to the first tilt axis of the Cartesian polarizing beam-splitter so that the polarized beam is nominally polarization rotated into the opposite polarization direction with respect to the color separating surfaces and a respective beam of colored light exits through each of the exit surfaces; and
   d) a plurality of polarization modulating imagers, each imager placed at one of the exit surface of the color separating and recombining prism to receive one of the respective beams of colored light, wherein each imager can separately modulate the polarization state of the beam of colored light incident on said imagers.

2. The optical imaging system of claim 1, wherein the first polarization direction is nominally s-polarization and the second polarization direction is nominally p-polarization.

4. The optical imaging system of claim 1, wherein the illumination system provides a beam of substantially pre-polarized light.

5. The optical imaging system of claim 1, wherein the color separation and recombination prism includes at least three exit surfaces, and the plurality of imagers includes at least three imagers, wherein each of the colored light beams is a different color and each imager receives one of the different color light beams.

6. The optical imaging system of claim 1, wherein each imager reflects a polarization modulated image, wherein the images reflected by the imagers enter the color separation and recombination prism and the prism recombines the images into a single combined image, wherein the combined image is transmitted by the Cartesian polarizing beam splitter.

7. The optical imaging system of claim 6, further comprising a projection lens assembly, wherein the combined image is projected by the lens assembly onto a surface for viewing.

9. The optical imaging system of claim 1, wherein the optical system is a rear projection system.

10. The optical imaging system of claim 1, wherein the color separation and recombination prism includes a Philips prism.

11. The optical imaging system of claim 1, wherein the Cartesian polarizing beam splitter includes a multilayer optical film.

12. The optical imaging system of claim 1, wherein the polarization modulating imagers include a LCOS imager.

13. A projection system comprising:

a) a Cartesian polarizing beam splitter, the Cartesian polarizing beam splitter defining a first tilt axis;

b) a color separation prism assembly, the prism assembly having a second tilt axis;

c) wherein the Cartesian polarizing beam splitter and the prism assembly are arranged such that the first and the second tilt axes are perpendicular to each other.

APPENDIX 2

OFFICE ACTIONS AND AMENDMENTS/RESPONSES

A. First Requirement to Elect Species, February 27, 2002

B. Election of Species, March 27, 2002

C. Restriction Requirement and Election of Species, June 18, 2002

D. Response to Restriction Requirement, July 18, 2002

E. First Office Action, October 24, 2002

F. Response to First Office Action, January 24, 2003

G. Final Office Action, May 9, 2003

H. Response to Final Office Action, July 9, 2003

I. Advisory Action, July 28, 2003

APPENDIX 3

REFERENCES RELIED UPON BY THE EXAMINER

A. JP Patent Publication 63039394 (Nagashima).

B. U.S. Patent No. 5,986,815 (Bryars '815).

C. U.S. Patent No. 6,144,498 (Bryars '498).

D. U.S. Patent No. 6,250,762 B1 (Kuijper).

E. U.S. Patent No. 6,390,626 B2 (Knox).